Memorandum

To: Michele Boomhower
VTrans Director of Policy, Planning & Intermodal Development Division

Date: December 2, 2019

Project #: 57981.00

From: David Saladino, P.E., AICP

Re: Burlington Amtrak Train Servicing and Storage Facility Assessment Technical Addendum

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This technical memorandum serves as an addendum to the *Burlington Amtrak Train Servicing and Storage Facility Assessment* report (June 2019) and provides an updated Evaluation Matrix and supporting technical background associated with a potential sixth Amtrak train servicing and storage location located adjacent to the McNeil Generating Station in Burlington, Vermont.

McNeil Site Overview

Figure 1: Potential Train Servicing & Storage Location Sites

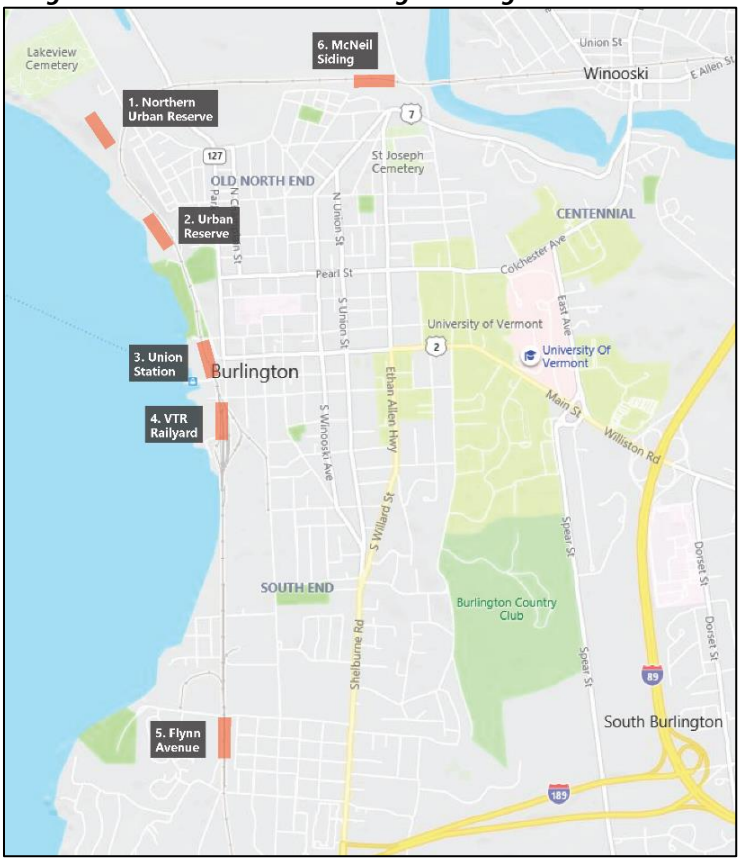

Figure 1 to the right shows the location of the McNeil site in relation to the other five potential locations identified and evaluated in the June 2019 *Site Assessment* report. The McNeil site is located along the New England Central Railroad (NECR) Winooski Branch line adjacent to the McNeil Generating Station and Queen City Steel, north of Riverside Avenue and west of Intervale Road in the north end of Burlington.

Figure 2 on the following page shows a conceptual plan of the proposed rail siding and access road immediately to the south of the existing NECR track. The proposed siding and access road fall entirely within the NECR right-of-way – which is owned and maintained by NECR.

For Amtrak to access this site, track rights from NECR would have to be acquired as the passenger train would use a portion of NECR's Winooski Branch line from College Street to Intervale Road.

This site would be located on a new siding immediately east of the McNeil Generating Plant on the southerly side of the NECR mainline track. This location is approximately 2.1 miles north of Union Station as measured along the rail corridor. This site is located at the base of the Winooski River bluff, approximately 80-85 feet below the elevation of the closest homes and businesses located off Riverside Avenue. This vertical separation

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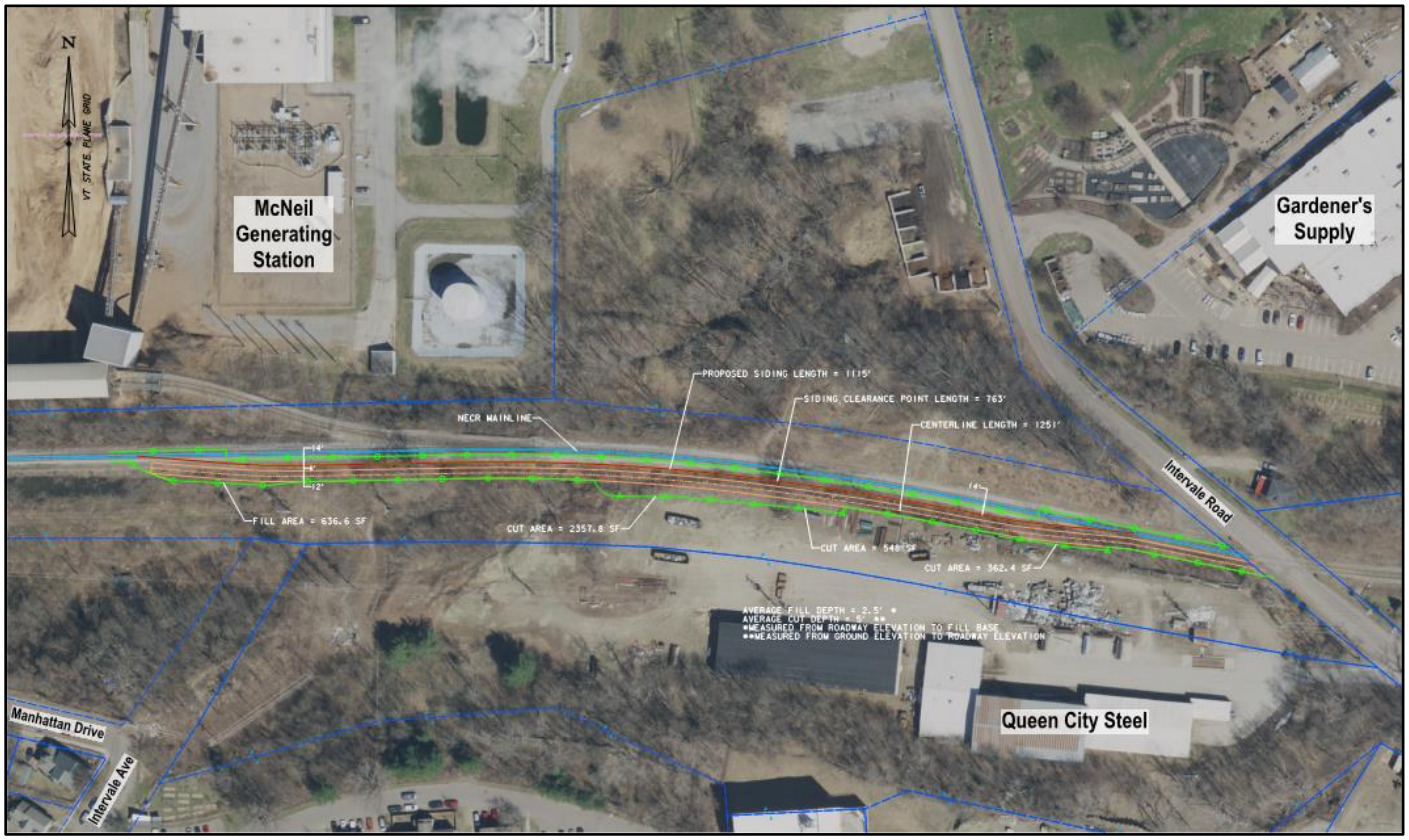
provides a moderate level of noise and visual screening from adjacent homes and businesses. For comparison purposes, the track in the Urban Reserve is approximately 90 feet below the homes on Lakeview Terrace.

To service and store the Amtrak train at this location, approximately 1,200-feet of new track, new switches, and approximately 1,300-feet of new access roadway would have to be constructed. This construction would require earthwork to ensure that the roadway and track would be located at the same grade. A three-phase power drop would be needed to provide access from the existing power lines in the vicinity. The construction of this track, roadway, and related infrastructure is estimated to cost approximately $1,500,000.

Figure 2: McNeil Site Siding and Access Road - Concept Plan



Evaluation Criteria

The potential McNeil train servicing and and storage location was evaluated using the same methodology and metrics used for the other five sites. These criteria are summarized below:

- Design, Construction, and Property Acquisition Costs were calculated using unit costs from VTrans, Vermont Railway (VTR), and previously completed railroad construction projects. Construction of the McNeil Siding is estimated to cost approximately $1,500,000 for new track, two switches, electrical power service, and a new access road.
- Electrical Power Availability was based on the proximity of the nearest three-phase power supply and the necessary infrastructure required to connect the train to the electrical power grid. Three-phase power is required for the "hot start" device to keep the diesel fuel from gelling without having to idle the locomotive all night. Three-phase power is available near the McNeil siding but would require a power drop line to the siding.
- Additional Crew Hours were calculated and included as a criterion because of federal regulations which restrict the number of consecutive hours a crew can work to 12 hours. After this period of time, a minimum break of ten hours is required. The calculations were based on the amount of time it would take to bring the train from Union Station to the McNeil siding, then have the crew travel to downtown Burlington, where it is assumed the crew would be lodged overnight. There is also additional morning delay of travelling back to the train and bringing it to Union Station for passenger pick-up.
- Property Acquisition is required anywhere that the property is not already owned by the State or locations that would require a lease agreement with VTR or NECR. The McNeil siding property is owned by NECR which would require a lease agreement between VTR and NECR. VTR is expected to be the maintenance provider and point of contact for this train as they are located in Burlington, whereas NECR is based in St. Albans.
- Natural Resource Constraints were measured based on a desktop review of the sites and adjacent mapped natural resources such as wetlands, rare, threatened, and endangered species, river corridors, and floodplains. Two rare species were identified proximate to the site. Upon further inspection, one of the species is an aquatic organism whose presence is likely limited to the Winooski River corridor and the second is not a state- or federally-protected species.
- Lighting Impacts were estimated based on Amtrak lighting requirements for overnight storage, the proximity to residential areas, whether there is already lighting in the location, or if new lighting is being introduced to an area. The servicing and storage area lighting would be a low-level light overnight which increases in brightness when being serviced. There is current ambient light in the vicinity of this site from adjacent industrial buildings, but additional lighting would be required for servicing and security.

- Visual Impacts were evaluated based on how visible the train would be from various angles. Taking topography and adjacent land uses into consideration, this site is anticipated to have little to no impact on adjacent neighborhoods as it located significantly down slope from adjacent residential areas and has ample tree coverage.
- Noise Impacts from the idling locomotive was evaluated using Cadna-A[1] sound prediction software which utilizes the methods outlined in the International Standards Organization (ISO) Standard 9613-2:2006[2]. This prediction method considers the topography, ground cover, wind conditions, and intervening objects such as buildings. The following summarizes the principal assumptions of the noise model:
    - Moderate downwind conditions are assumed which conservatively predict efficient sound propagation from the source to receptors in all directions.
    - Sound attenuation is affected by shielding and diffraction provided by local buildings intervening the propagation path between the source and receptors.
    - Ground cover in the study area depends on site specific conditions. The McNeil site was assumed to be surrounded by earth, grass, and other vegetation which provide acoustically soft ground.

  Noise was analyzed assuming one idling locomotive at the potential storage and servicing site. The reference sound level of the idling locomotive used in the study was determined using measurements of an idling Amtrak P32AC Locomotive at the Amtrak Station in Rutland, Vermont on September 7, 2018. Measurements were conducted using an ANSI Type I sound level meter (Larson Davis Model 831) and employed best measurement practices. The P32AC is an older model of locomotive than will be used for the Burlington service. The newer locomotives are anticipated to be quieter than those currently in service, so the resulting analysis should be construed as an order-of-magnitude evaluation and not necessarily an exact estimate of noise at a given location.

  Noise receptors were identified at all residential parcels experiencing sound levels 40 dBA and greater from the idling locomotives using a combination of available parcel data, aerial photography, and Google Street View™. Noise receptors were identified at single-family residences and multi-family residences and were tabulated according to the number of dwelling units. The number of residences that would be exposed to sound levels between 40 to 50 dBA, 50 to 60 dBA, and greater than 60 dBA were quantified.

  Per information from Amtrak, "hot start" equipment would be integrated into the locomotives which would eliminate the need for the locomotives to idle overnight. With this equipment in place, the train would only

[1] Computer Aided Noise Abatement (Cadna-A). DataKustik GmbH. Version 2017.
[2] "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation" ISO 9613-2:2006. 2006.

need to go through a 20 to 40-minute power up and power down sequence upon departure and arrival, limiting the duration of noise impacts. The noise analysis is elaborated upon in more detail in Appendix C.

The McNeil Site would be setback from residences at relatively similar distances as the Northern Urban Reserve and Urban Reserves sites, but there are a greater number of multi-family residences near the McNeil Site. Therefore, there would be a greater number of residences that would be exposed to locomotive idling noise 50 dBA or greater at the McNeil Site compared to the Northern Urban Reserve and Urban Reserve sites.

- Air Quality and Emissions were analyzed assuming one idling locomotive at each potential storage site for 40 minutes. Pollutant dispersion modeling was conducted using the AERSCREEN dispersion model3 which is a screening model that uses worst-case meteorology to conservatively estimate pollutant concentrations. Additionally, models were developed with the appropriate geometry for homes along Manhattan Drive and Riverside Avenue near the McNeil Site as these receptors are elevated relative to the tracks.

  The results of the dispersion modeling for each location show that only nitrogen dioxide emissions from the locomotive have the potential to approach or exceed the National Ambient Air Quality Standards (NAAQS) under the 1-hour averaging period at the Union Station Site. Elevated receptors (such as balconies) may experience nitrogen dioxide emissions greater than the NAAQS within 50 feet of the locomotive. Nitrogen dioxide concentrations at all ground level receptors at all sites and elevated homes along Lakeview Terrace, Manhattan Drive, and Riverside Avenue would be well below the NAAQS.

  Pollutant concentrations from the idling locomotive for all criteria pollutants and averaging periods are well below the NAAQS criteria at the McNeil site. A copy of the Air Quality Assessment memorandum is provided in Appendix C.

- Proximity to Residential Areas is a straight-line measurement from each train servicing and storage location to the nearest residence. This distance was measured to be under 0.1 mile for the McNeil siding.

- Impacts to VTR & NECR Operations were based on potential impacts to VTR and NECR daily freight rail operations. These operations include, but are not limited to, loading, unloading, servicing, building and storing trains. This site is located approximately 2 miles from VTR rail lines, resulting in minimal impacts to VTR operations. Impacts to NECR operations are primarily related to potential impacts to NECR's wood chip trains that service the McNeil Generating Station. Since the Amtrak train would be stored and serviced overnight on a separate siding, impacts on the wood chip trains would be limited.

[3] AERSCREEN Dispersion Model, Version 16121r, US Environmental Protection Agency.

Evaluation Matrix

An evaluation matrix was created to summarize the scoring assigned to each metric for each location. The evaluation matrix and total scores for each site are summarized in **Table 1** on the following page. Each of the evaluation criterion was scored on a scale of 0 to 3 with zero representing the lowest possible score and three representing the highest possible score for each metric. The highest possible score for a given site is 33 points. No weighting was applied to the scoring metrics.

Table 1: Evaluation Matrix

Location	Estimated Costs		Electrical Power Availability		Additional Crew Hours		Property Acquisition		Natural Resource impacts		Lighting Impacts	
	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments
Northern Urban Reserve	2	$2,290,000 (new track and switch, electrical power, utilities, and new access road)	2	New electrical lines and connection required	2	44 minutes per day	1	Acquisition required from the City of Burlington	3	No anticipated impacts	1	Lighting will be added in an area where there are currently no lights
Urban Reserve	2	$2,240,000 (new track and switch, earthwork, electrical power, utilities)	2	New electrical lines and connection required	2	40 minutes per day	1	Acquisition required from the City of Burlington	3	No anticipated impacts	1	Lighting will be added in an area where there are currently no lights
Union Station	3	$300,000 (electrical power)	3	New connection to existing electrical line required	3	0 minutes per day	3	This is located within an existing railroad corridor owned by the State	3	No anticipated impacts	2	Brighter lighting will be required overnight
VTR Railyard	0	$50,000,000 (relocation of Railyard to alleviate operational conflicts)	3	New connection to existing electrical line required	2	30 minutes per day	2	Lease agreements will need to be made with VRS	3	No anticipated impacts	2	Brighter lighting will be required outside of current Railyard operational hours.
Flynn Avenue	2	$1,500,000 (relocation of VRS storage currently on this siding)	2	New electrical lines and connection required	1	60 minutes per day	2	Lease agreements will need to be made with VRS	3	No anticipated impacts	2	Brighter lighting will be required overnight
McNeil Siding	2	$1,500,000 (new track, two switches, electric power, and new access road)	3	New connection to existing electrical line required	1	75 minutes per day	1	Property owned by NECR; Lease agreement needed	3	No anticipated impacts	2	Brighter lighting will be required overnight

Location	Train Visibility		Noise Impacts		Horn Impacts		Air Quality & Emissions		Proximity to Residential Areas		Impacts to Freight Rail Operations		Total Score	Ranking
	Score	Comments	Score	Number of Residences Impacted[2]	Score	Number of Additional Horn Warnings[3]	Score	Comments	Score	Comments	Score	Comments		
Northern Urban Reserve	3	The train will be located down slope from most homes and will not be easily visible from the east	1	50 residences	1	4 Additional Horn Warnings	3	Does not exceed NAAQS[4]	3	The train is less than 528 feet from residences but is significantly down slope	2	Minor impacts to VRS operations. The train would be stored on a new siding off of a VRS siding north of the railyard	**24**	**3**
Urban Reserve	2	The train will be located down slope from most homes and will be slightly visible from the east	1	62 residences	1	4 Additional Horn Warnings	3	Does not exceed NAAQS	3	The train is less than 528 feet from residences but is significantly down slope	2	Minor impacts to VRS operations. The train would be stored on a new siding off of the VRS main line north of the railyard limits	**23**	**5**
Union Station	1	The train will be located between Union Station and ECHO	2	26 residences	3	0 Additional Horn Warnings	0	Potentially exceeds Nitrogen Dioxide standard	0	The train is less than 50 feet from residences	3	No impacts to VRS operations. The train would be stored on a new siding off of the VRS track	**26**	**1**
VTR Railyard	3	The train will be located within an existing railyard and will not significantly change the current views	3	12 residences	1	4 Additional Horn Warnings	3	Does not exceed NAAQS	2	The train is less than 528 feet from residences	0	Major impacts to VRS operations. The train would be in direct conflict with current VRS operations	**24**	**3**
Flynn Avenue	2	The train will be stored in an area which often has trains currently but it located close to many residences	0	160 residences	1	4 Additional Horn Warnings	3	Does not exceed NAAQS	2	The train is less than 528 feet from residences	1	Significant impacts to VRS operations. The train would be stored on a siding currently used by VRS or along a siding which would disrupt Railyard operations	**21**	**6**
McNeil Siding	3	The train will be located down slope from most homes and will not be easily visible from Riverside Avenue	1	85 residences	1	4 Additional Horn Warnings	3	Does not exceed NAAQS	3	The train is less than 528 feet from residences but is significantly down slope	2	No impacts to VRS operations. Minor impacts anticipated to NECR's wood chip train.	**25**	**2**

[2] *Number of Residences with dBAs more than 50*

[3] *Additional horn warnings necessary at road crossings from and to the Union Station*

[4] *National Ambient Quality Standards for specific pollutants*

Appendices

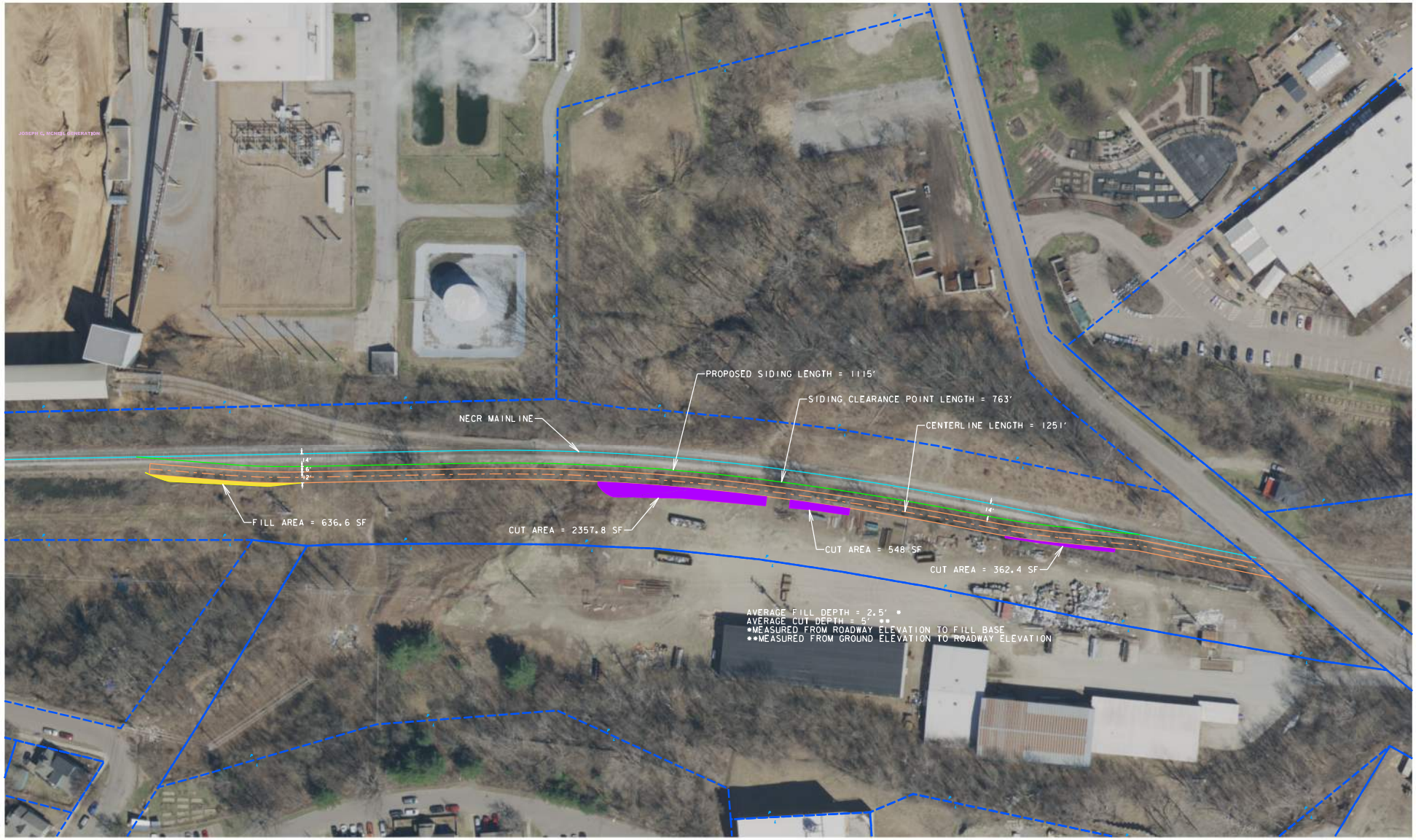
Appendix A - Concept Plan and Maps

Appendix B - Amtrak Design Criteria

Appendix C - Noise and Air Evaluation

Appendix D - Conceptual Cost Estimate

Appendix A - **Concept Plan and** Maps



vhb

PROJECT NAME:	VAOT PROJECT NAME
PROJECT NUMBER:	PROJECT NUMBER

FILE NAME: ppms*/Section/------.dgn	PLOT DATE: 10/24/2019
PROJECT LEADER: ------	DRAWN BY: ------
DESIGNED BY: ------	CHECKED BY: ------
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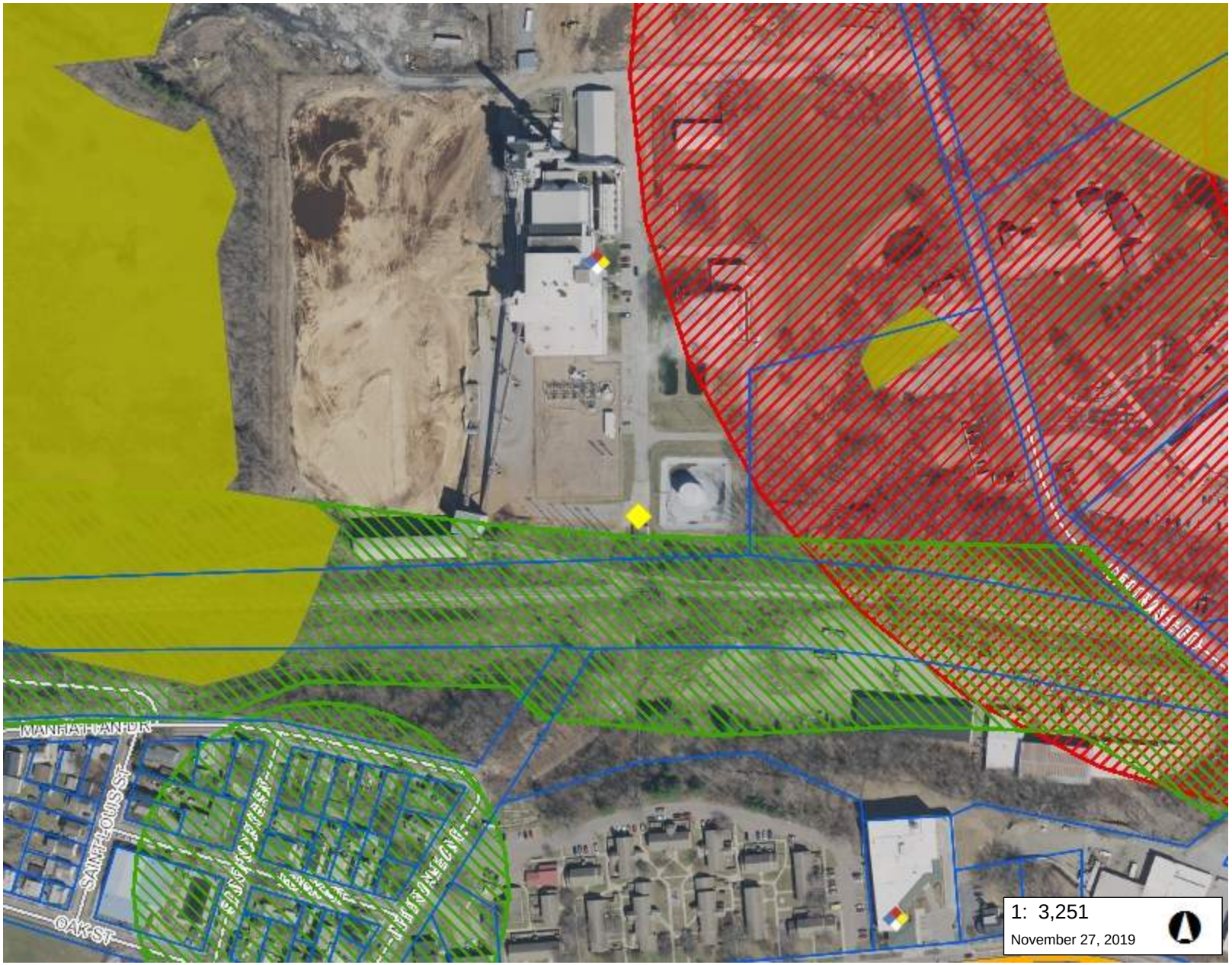
McNeil Siding - Natural Resource Map

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Wetland - VSWI
  - Class 1 Wetland
  - Class 2 Wetland
  - Buffer
- Hazardous Site
- Hazardous Waste Generators
- Rare Threatened Endangered
  - Threatened or Endangered
  - Rare
- Parcels (standardized)
- Roads
  - Interstate
  - Principal Arterial
  - Minor Arterial
  - Major Collector
  - Minor Collector
  - Local
  - Not part of function Classification S

NOTES

Map created using ANR's Natural Resources Atlas

165.0 0 82.00 165.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 271 Ft. 1cm = 33 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Appendix B – **Amtrak** Design **Criteria**

Burlington, VT

Amtrak Design Criteria for Proposed Layover Facility

In preparation for extended service of the Ethan Allen line from Rutland to Burlington with two intermittent stops at Vergennes and Middlebury, Amtrak operations requests a designated layover siding, separated from passenger boarding platforms, for train turnovers with the following recommended components:

Lighting:

Brightness Level: 2fc to 5 fc when inactive / 20 fc when active
Type: LED with step dimming control by motion sensors highly recommended

Electrical Power:

Air Compressor: 480V, 3 phase service (30 amp breaker)
Train Disconnect Panel: 480V, 3 phase service (800 amp breaker)
Location: Near rear of engine

Water Service:

Service Station: One (1) Snyder service station for every two (2) coaches.
Assume six (6) coaches for Ethan Allen line for three (3) stations.
Location: 112' from the front of the engine / 170' intervals thereafter.
Sanitary: Provide sanitary sewer dump station for 'honey dipper' truck usage.
Water Supply Lines: Provide 2" water lines to each service station.
Power: 120 VAC, 40 amp service to each water service station.
General: Provide tap, meter, and backflow preventer per codes.

Air:

Compressor: Saylor Beall Air Compressor (model 735-80, Series 5-96-R04) with 80 gallon tank and 5hp motor.
Locate in 10'x10' shed.
Provide 480v, 3 phase service with disconnect switch.

Platform:

Height: Low level 8" ATR – *assume access by on-board stairways*
Length: 600' - *Based on existing Ethan Allen Amfleet coaches.*
Covering: 75' long roof shed for Locomotive. See Amtrak SDP for specific design criteria.

Access, ROW, Storage:

Storage: Provide enclosed, lockable storage for cleaners and equipment.
Exact sizes and quantities TBD, estimated two or three 10'x10'sheds.
Yard: Parking for one (1) Honey Dipper truck, three (3) to five (5) service vans.
Access Driveway: 12' wide access road along track.

Crew Base / Staff Facilities:

Not needed at this location. Crew procedure is taxi to off-site accommodations.

Appendix C – Noise and Air Evaluation

Memorandum

To: VTrans

Date: November 30, 2019

Project #: 57981.00

From: VHB

Re: Burlington Amtrak Storage Facility
Noise Analysis

The Chittenden County Regional Planning Commission (CCRPC), the City of Burlington (COB), the Vermont Agency of Transportation (VTrans), and Vermont Rail Systems (VRS), are collaborating on a study to identify an overnight storage and servicing location for the future Amtrak passenger train in the greater Burlington area. A component of evaluating the feasibility of the six potential storage sites are potential noise effects from idling locomotives at nearby sensitive locations including residences. This memorandum presents background information on noise, summarizes the assessment methodology, and presents results of the noise analysis.

Noise Background

Sound is the rapid fluctuations of air pressure above and below ambient pressure levels. Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, communication or recreation. How people perceive sound depends on several measurable physical characteristics including:

- **Sound Level** - Sound level is based on the amplitude change in pressure and is related to the loudness or intensity. Human hearing covers a wide range of changes in sound pressure amplitude. Therefore, sound levels are most often measured on a logarithmic scale of decibels (dB) relative to 20 micro-pascals. The decibel scale compresses the audible range of acoustic pressure levels, which can vary from the threshold of hearing (0 dB) to the threshold of pain (120 dB). Because sound levels are measured in dB, the addition of two sound levels is not linear. For example, adding two equal sound levels results in a 3 dB increase in the overall level. Research indicates the general relationships between sound level and human perception are as follows:
  - A 3-dB increase is a doubling of acoustic energy and is approximately the smallest difference in sound level that can be perceived in most environments.
  - A 10-dB increase is a tenfold increase in acoustic energy and is generally perceived as a doubling in loudness to the average person.
- **Frequency** - Sounds are comprised of acoustic energy distributed over a range of frequencies. Acoustic frequencies, commonly referred to as tone or pitch, are typically measured in Hertz. Human hearing generally ranges from 20 to 20,000 Hz; however, the human ear does not perceive sound levels from each frequency as equally loud. To compensate for this phenomenon in perception, a frequency filter known as A-weighting [dBA] is commonly used to evaluate environmental noise levels.
  - Sound levels reported in octave or one-third-octave frequency bands are often used to describe the frequency content of different sounds. Some sources of sound can generate "pure tones" which is when there is a concentration of sound within a narrow frequency range such as a whistle. Humans can hear pure tones very well and such conditions can be a cause of increased annoyance.

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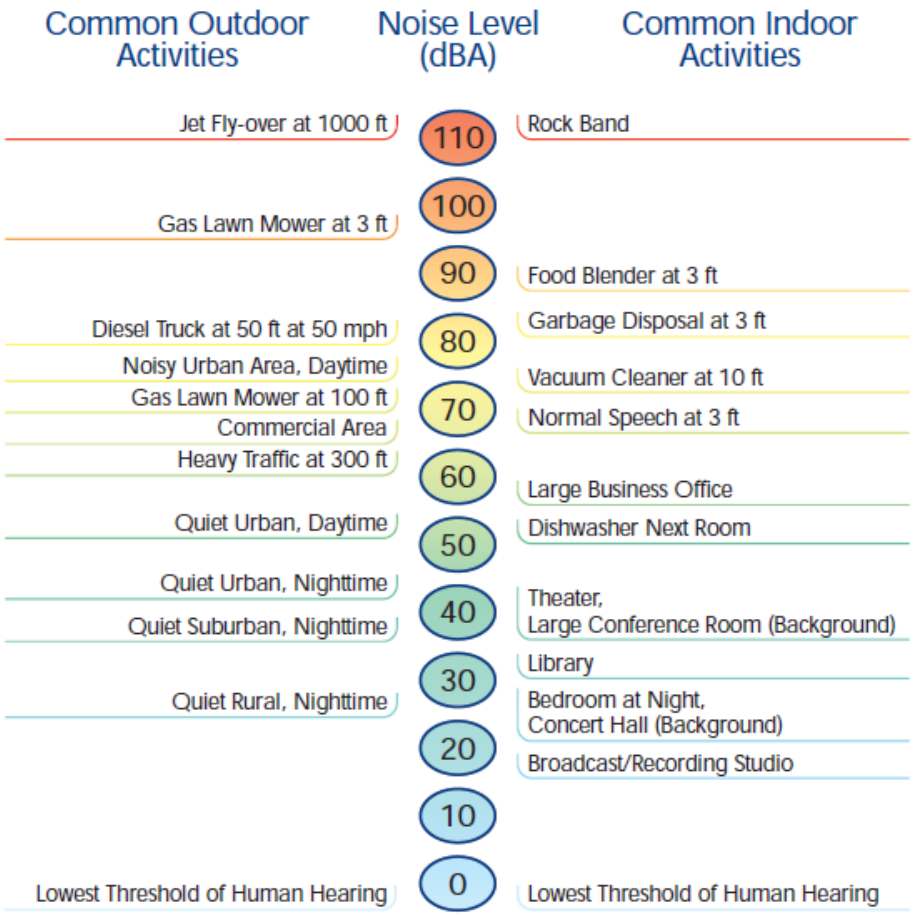
A variety of sound level descriptors can be used for environmental noise analyses. These descriptors relate to the way sound varies in level over time. The following is a list of common sound level descriptors:

- The *Maximum A-weighted Level* (Lmax) represents the highest sound level generated by a source. For mobile sources, the maximum level typically occurs when the source is closest to the measurement or analysis location.
- The *Energy-average Level* (Leq) is a single value that is equivalent in sound energy to the fluctuating levels over a period of time. The Leq accounts for how loud events are during the period, how long they last, and how many times they occur. Typically, Leq sound levels are used to describe the time-varying sound level over a 1-hour period and may be denoted as Leq_{1h}. Leq is commonly used to describe environmental noise and relates well to human annoyance.

Figure 1 shows typical A-weighted sound levels for common outdoor and indoor activities.

- **Figure 1 Typical Ambient Outdoor and Indoor Sound Levels**



Source: Caltrans, 2016.

Regulatory Context

Noise generated by the proposed locomotive storage has been evaluated according to the Federal Railroad Administration (FRA) equipment regulations and Burlington Noise Ordinance.

FRA Equipment Regulations

Noise is generated by diesel-electric locomotives while it is providing head end power (HEP) to the passenger coaches while idling. The HEP provides power to the rail cars without providing power to the traction motors. The FRA has equipment noise standards for all locomotives operating under stationary conditions with an idle throttle setting. As defined in 40 CFR 201.11, no locomotive manufactured after December 31, 1979 may exceed a maximum sound level of 70 dBA when operated at idle at a distance of 100 feet from the locomotive center. Since the Amtrak trains operate on a railroad subject to FRA jurisdiction, locomotives must comply with this noise standard.

Burlington Noise Ordinance

The City of Burlington has established a Noise Ordinance to preserve the public health, safety and welfare of its citizens. The purpose of the ordinance is to prohibit excessive and disturbing noise. The Burlington Noise Ordinance does not establish quantitative noise limits, but instead primarily focuses on restricting certain noise sources to specific times of day. The ordinance specifies express prohibitions on noise originating from parties, machinery, construction, loud speakers, radios, televisions and other sound amplification devices (including those in motor vehicles). A general prohibition is placed on any noise that disturbs, injures, or endangers the peace or health of any person or the community.

The Burlington Noise Ordinance does not prohibit noise generated from locomotives. Additionally, since noise from the locomotives is controlled by federal regulation, the local ordinance is not applied.

Analysis Methodology

Noise from the locomotives has been evaluated at each study location including nearby residential receptors.

Receptor Identification

Noise receptors were identified at all residential parcels experiencing sound levels 40 dBA and greater from the idling locomotives using a combination of available parcel data, aerial photography, and Google Street View™. Noise receptors were identified at single-family residences and multi-family residences and are tabulated according to the number of dwelling units. The number of residences that would be exposed to sound levels between 40 to 50 dBA, 50 to 60 dBA, and greater than 60 dBA.

Noise Sources

Noise was analyzed assuming one idling locomotive at each potential storage site. The reference sound level of the idling locomotive used in the study is provided in Table 1. The reference sound level was determined using measurements of an idling Amtrak P32AC Locomotive at the Amtrak Station in Rutland, Vermont on September 7, 2018. Measurements were conducted using ANSI Type I sound level meter (Larson Davis Model 831) and employed best measurement practices.

Table 1 Locomotive Idling Emissions at 100 feet (dBA)

		Frequency (Hz)							
Source	**Overall**	**63**	**125**	**250**	**500**	**1,000**	**2,000**	**4,000**	**8,000**
Idling Locomotive	77	72	63	66	68	68	67	65	64

Source: VHB measurements of an Amtrak P32AC Idling Locomotive on September 7, 2018.

Noise Model

Sound generated by the idling locomotive has been predicted using Cadna-A[1] sound prediction software which utilizes the methods outlined in the International Standards Organization (ISO) Standard 9613-2:2006[2]. This prediction method considers the topography, ground cover, wind conditions, and intervening objects such as buildings. The following summarizes the principal assumptions:

- Moderate downwind conditions are assumed which conservatively predict efficient sound propagation from the source to receptors in all directions.
- Sound attenuation is affected by shielding and diffraction provided by local buildings intervening the propagation path between the source and receptors.
- Ground cover in the study area depends on site-specific conditions. The McNeil site was assumed to be surrounded by earth, grass, and other vegetation which provide acoustically soft ground.

Analysis Results

Site 6, McNeil Siding Site, is located near the Joseph C. McNeil Generating Station. There are residences near this site along Riverside Avenue, Manhattan Drive, and Intervale Avenue which are elevated relative to the tracks. The terrain provides acoustic shielding from the idling locomotives. There would be no residences exposed to noise greater than 60 dBA. There would be approximately 85 residences exposed to sound levels between 50 and 60 dBA and 229 residences exposed to sound levels between 40 and 50 dBA.

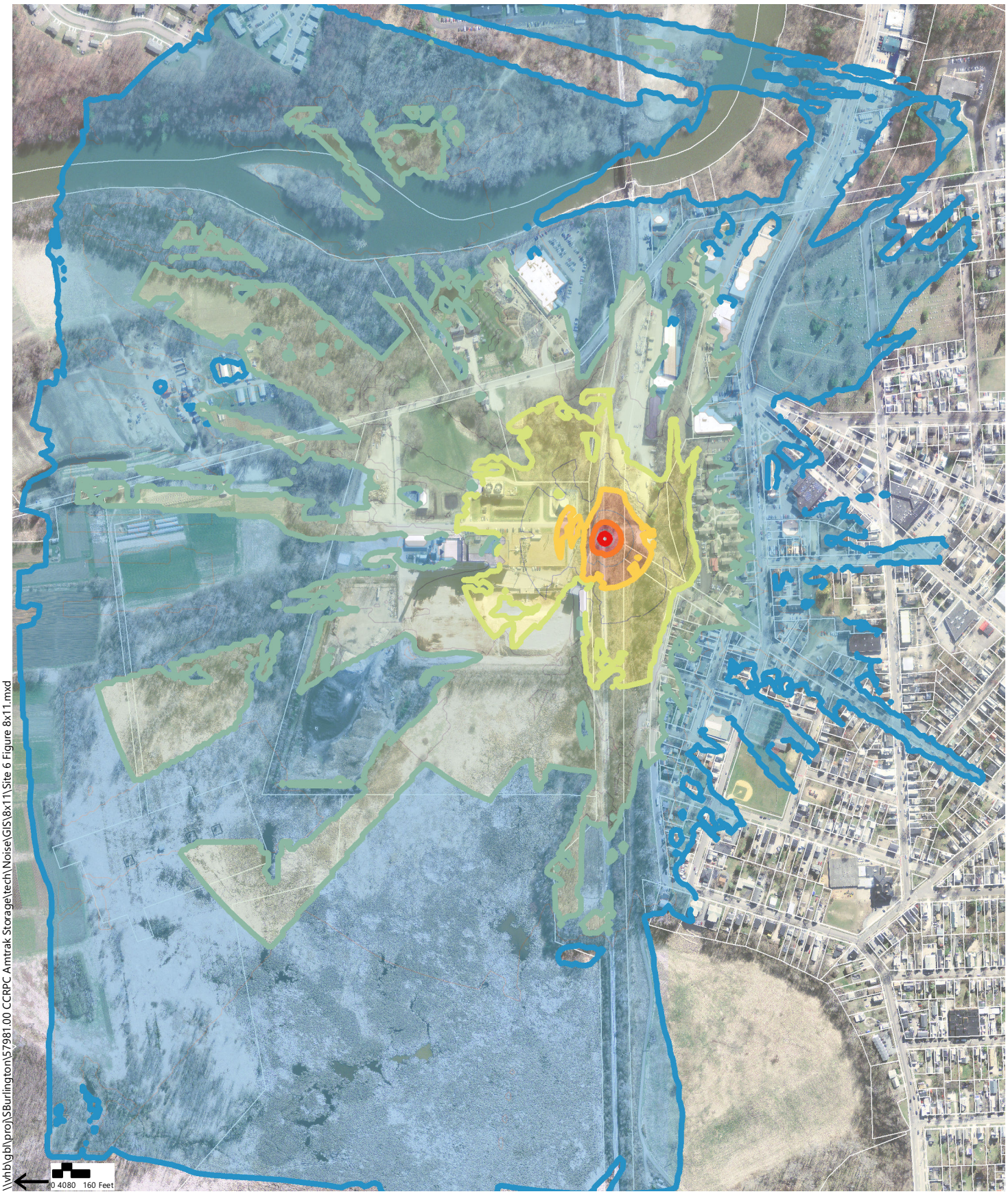
Table 2 presents the number of residences experiencing maximum (Lmax) sound levels between 40 and 50 dBA, between 50 and 60 dBA, between 60 and 70 dBA, between 70 and 80 dBA and greater than 80 dBA from the idling locomotive.

Table 2 Residential Receptors Exposed to Locomotive Sound

		Number of Residences				
Site	**Site Description**	**40-50 dBA**	**50-60 dBA**	**60-70 dBA**	**70-80 dBA**	**>80 dBA**
6	McNeil Siding	229	85	0	0	0

[1] Computer Aided Noise Abatement (Cadna-A). *DataKustik GmbH*. Version 2017. http://www.datakustik.com/en/products/cadnaa.

[2] "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation" ISO 9613-2:2006. 2006.



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Burlington Amtrak Servicing & Storage Facility Study | Burlington, Vermont

Sound Level Contours
McNeil Generating Station Siding

Sound Levels

40-50 dBA	60-70 dBA	40 dBA	70 dBA
50-60 dBA	70-80 dBA	50 dBA	80 dBA
	>80 dBA	60 dBA	90 dBA

Memorandum

To: VTrans

Date: November 30, 2019

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Air Quality Analysis

The Chittenden County Regional Planning Commission (CCRPC), the City of Burlington (COB), the Vermont Agency of Transportation (VTrans), and Vermont Rail Systems (VRS), are collaborating on a study to identify an overnight storage and servicing location for the future Amtrak passenger train in the greater Burlington area. A component of evaluating the feasibility of the six potential storage sites is potential air quality effects from idling locomotives at nearby sensitive locations including residences. This memorandum presents background information on air quality, summarizes the assessment methodology, and presents the results of the air quality analysis.

Regulatory Context

The air quality statutes and regulations that are applicable to the Storage Facility include the 1990 Clean Air Act Amendments (CAAA) and the National Ambient Air Quality Standards (NAAQS). The CAAA is the basis for most Federal air pollution control programs. The purpose of the CAAA is to preserve air quality and protect the public's health and welfare. Under the authority of the CAAA, the Environmental Protection Agency (EPA) regulates air quality nationally. EPA delegates authority to the Department of Environmental Conservation (DEC) for monitoring and enforcing air quality regulations in the State of Vermont. Conformity with the State Implementation Plan is not assessed in this analysis because the Storage Facility is located in Chittenden County, which is designated by the EPA as in Attainment (i.e., in compliance with applicable standards) for all criteria pollutants. Therefore, this area is exempt from conformity requirements.

Under authority of the CAAA, the EPA established the NAAQS that define allowable limits for atmospheric concentrations of various criteria air pollutants including particulates. Primary standards are established at levels designed to protect the public health. Secondary standards are established at levels designed to protect the public welfare by accounting for the effects of air pollution on vegetation, soil, materials, visibility, and other aspects of the general welfare. The EPA has set the NAAQS for criteria pollutants to protect the public health and welfare. Table 1 presents the NAAQS for these pollutants.

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Table 1 National Ambient Air Quality Standards

Pollutant	Averaging Period	Primary Standard	Secondary Standard	Form
Carbon Monoxide (ppm)	8-hour	9	-	Not to be exceeded more than once per year
	1-hour	35	-	
Nitrogen Dioxide (ppb)	1-hour	100	-	98th percentile of daily maximum concentrations, averaged over 3 years
	Annual[a]	53	53	Annual Mean
Ozone (ppm)	8-hour[b]	0.070	0.070	Annual 4th highest daily maximum concentration, averaged over 3 years
Particulate Matter 2.5 ($\mu g/m^3$)	Annual	12	15	Annual mean, averaged over 3 years
	24-hour	35	35	98th percentile, averaged over 3 years
Particulate Matter 10 ($\mu g/m^3$)	24-hour	150	150	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (ppb)	1-hour[c]	75	-	99th percentile of daily maximum concentrations, averaged over 3 years
	3-hour	-	0.5	Not to be exceeded more than once per year
Lead ($\mu g/m^3$)	3-month average[d]	0.15	0.15	Not to be exceeded

Source: US Environmental Protection Agency

[a] The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

[b] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

[c] The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 C.F.R. §50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the require NAAQS.

[d] In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 $\mu g/m^3$ as a calendar quarter average) also remain in effect.

(ppm) – parts per million; (ppb) – parts per billion; ($\mu g/m^3$) – micrograms per meter cubed

Analysis Methodology

Air Quality from the locomotives has been evaluated at each study location for nearby residential receptors and locations of ambient air.

Background Concentrations

Background concentrations were obtained from the DEC, who maintain a network of ambient air monitors across the state in response to the CAAA. Background concentrations are added to project emission sources to determine the total pollutant concentration at a receptor location for comparison to the NAAQS. The most current background

concentrations were obtained from the DEC's recommended background concentrations for air quality monitoring.[1] Concentrations were chosen from the monitoring location closest to the Storage Facility (the Burlington monitoring site). Only pollutants that were considered in the air quality modeling are presented in Table 2. The criteria pollutants not considered in the air quality modeling (Ozone, Sulfur Dioxide, and Lead) are not studied because they are not substantially emitted by locomotives. All background concentrations are well below the NAAQS and demonstrate Chittenden County's Attainment designation by the EPA.

Table 2 Background Concentrations

Pollutant	Units	Averaging Period	Background Concentration	NAAQS Standard
Carbon Monoxide	ppm	8-hour	0.6	9
	ppm	1-hour	1.2	35
Nitrogen Dioxide	ppb	1-hour	33	100
	ppb	Annual	6.5	53
Particulate Matter 2.5	$\mu g/m^3$	Annual	6.0	12
	$\mu g/m^3$	24-hour	10	35
Particulate Matter 10	$\mu g/m^3$	24-hour	32	150

Source: Vermont Department of Environmental Conservation.

Emission Sources

Locomotive emissions were analyzed assuming one idling locomotive at each potential storage site for 40 minutes. The reference emission factors of the idling locomotive used in the study were retrieved from "Emission Factors for Locomotives", an EPA guidance document.[2] The emission factors are for an Amtrak P32AC Locomotive under the Tier 0 emission standard and with an engine power representative of idling conditions.

Dispersion Model

Pollutant dispersion modeling was conducted using the AERSCREEN dispersion model.[3] AERSCREEN is a screening model that uses worst-case meteorology to conservatively estimate pollutant concentrations. Dispersion modeling was conducted for receptors located 6 feet above the ground that were placed between the locomotive stack and 500 feet for NO_2 and 150 feet for other pollutants. These ranges were sufficient to capture the distance that experiences the maximum pollutant concentration from locomotive emissions. Additionally, models were developed with the appropriate geometry for homes along Manhattan Drive and Riverside Avenue near the McNeil Site as these receptors

[1] "Ambient Monitoring Background Data For Use In Air Quality Impact Evaluation". Vermont Department of Environmental Conservation. http://dec.vermont.gov/air-quality/permits/construction/background-data. Accessed October 4, 2018.
[2] "Emission Factors for Locomotives". US Environmental Protection Agency. EPA-420-F-09-025. April 2009.
[3] AERSCREEN Dispersion Model, Version 16121r, US Environmental Protection Agency.

are elevated relative to the tracks. Pollutant concentrations with averaging periods other than 1-hour were modeled using the recommended persistence factors from the "AERSCREEN User's Guide".[4]

Analysis Results

The results of the dispersion modeling for the Storage Facility show pollutant concentrations from the idling locomotive for all criteria pollutants and averaging periods are below the NAAQS criteria at all receptor locations at the McNeil site. The potential to exceed the NAAQS for each site is summarized in Table 3.

Table 3 Potential for Air Quality Impact by Site

Site	Site Description	Potential to Exceed NAAQS?	Potential Exceedance Location
6	McNeil Siding	All Pollutants: No	N/A

[4] "AERSCREEN User's Guide". US Environmental Protection Agency. EPA-454/B-16-004. December 2016.

Appendix **D – Conceptual Cost Estimate**

Computations

Project:	**Amtrak Storage**	**Project #:**	**57981.00**
Location:	**Burlington, VT**	**Sheet:**	
Calculated by:	**JDA**	**Date:**	**12/27/2017**
Checked by:	**ELQ**	**Date:**	**3/27/18**
Revised	**EC**	**Revised:**	**5/10/19**
Revised	**JDS**	**Revised:**	**11/25/19**
Title:	**Conceptual Cost Estimates**		

Conceptual Cost Estimates Summary

Site #	Description	Estimated Costs
1	Northern Reserve	$2,290,000
2	Urban Reserve	$2,240,000
3	Train Station	$300,000
4	Railyard	$50,000,000
5	City Market	$1,500,000
6	McNeil Generating Station	$1,500,000

Computations

Project:	**Amtrak Storage**	**Project #:**	**57981.00**
Location:	**Burlington, VT**	**Sheet:**	
Calculated by:	**JDA**	**Date:**	**12/27/2017**
Checked by:	**ELQ**	**Date:**	**3/27/18**
Revised:	**EC**	**Date:**	**5/10/19**
Title:	**Burlington Amtrak Storage Cost Estimates**		

1. Northern Urban Reserve

		length (EST), ft	unit cost ($/mi)	unit cost ($/ft)	Cost ($)
Roadway	New road segment	1200	$3,000,000	$568	$681,818
Utilities	Electrical Connection	1		$300,000	$300,000
Railroad	New Siding	700		$250	$175,000
	New Track north College St	200		$250	$50,000
	New Signal and Gates	1		$1,000,000	$1,000,000
	New Switch	1		$75,000	$75,000
				Subtotal:	$2,281,818
				Rounded total:	$2,290,000

2. Urban Reserve

		length (EST), ft	unit cost ($/mi)	unit cost ($/ft)	Cost ($)
Roadway	New road segment	500	$3,000,000	$568.18	$284,091
Utilities	Electrical Connection	1		$300,000	$300,000
Railroad	New Siding and Retaining Wall	700		$750	$525,000
	New Track north College St	200		$250	$50,000
	New Signal and Gates	1		$1,000,000	$1,000,000
	New Switch	1		$75,000	$75,000
				Subtotal:	$2,234,091
				Rounded total:	$2,240,000

3. Train Station

		length (EST), ft	unit cost ($/mi)	unit cost ($/ft)	Conc. Cost ($)
Roadway	New road segment	n/a			
	Rehab road segment	n/a			
Utilities	Electrical Connection	1		$300,000	$300,000
Railroad	New Track	n/a			
	New Switch	n/a			
				Subtotal:	$300,000
				Rounded total:	$300,000

Project:	**Amtrak Storage**	**Project #:**	**57981.00**
Location:	**Burlington, VT**	**Sheet:**	
Calculated by:	**JDA**	**Date:**	**10/13/17**
Checked by:	**ELQ**	**Date:**	**3/27/18**
Title:	**Unit Costs for Reference**		

Conceptual Cost Estimates: Unit Costs

Estimated Railroad Siding Cost

	Est. Cost	Cost Unit
Two Lane Roadway	$250	Foot

Unit Cost: $250 per foot

Estimated Railroad Switch Cost

	Est. Cost	Cost Unit
Railroad turn out	$75,000	Each

Unit Cost: $75,000 each

Estimated New Two Lane Roadway Cost

	Est. Cost	Cost Unit
Two Lane Roadway	$3,000,000	Mile

* Source: American Road & Transportation Builders Association FAQs

Unit Cost: $3,000,000 per mile

Estimated Conversion of existing Road Segment

	Est. Cost	Cost Unit
Two Lane Roadway	$1,000,000	Mile

* Source: American Road & Transportation Builders Association FAQs

Unit Cost: $1,000,000 per mile

Estimated Cost to Remove Road Segment

	Est. Cost	Cost Unit
Remove Road	$400,000	Mile

$75.76 per foot

Unit Cost: $400,000 per mile

Project:	**Amtrak Storage**	**Project #:**	**57981.00**
Location:	**Burlington, VT**	**Sheet:**	
Calculated by:	**JDA**	**Date:**	**10/13/17**
Checked by:	**ELQ**	**Date:**	**3/27/18**
Title:	**Unit Costs for Reference**		

Conceptual Cost Estimates: Unit Costs

Bike Path Relocation

	unit $ / ft
New 10' Shared Use Path, per ft*	$250
Remove existing bike path, per ft**	$32
Subtotal:	$282
Rounded total:	$290 per foot

Estimated Water Line Costs

	Est. Cost	Cost Unit
Water Line	$190	Each

* Source: Previous VHB Project Estimates

Unit Cost: $190 each

Estimated Sewer Line Costs

	Est. Cost	Cost Unit
Sewer Line	$150	Feet

* Source: Research and Engineering Judgement

Unit Cost: $150 per foot

Estimated Electrical Connection

	Est. Cost	Cost Unit
Electrical Connection	$300,000	Each

* Source: Research and Engineering Judgement

Unit Cost: $300,000 each

Estimated Rail Crossing Signal Cost

	Est. Cost	Cost Unit
Rail Crossing Signal	$1,000,000	Each

Unit Cost: $1,000,000 each

Computations

Project: Amtrak Train Storage
Location: Burlington, VT
Calculated by: S.E. Burbank
Checked by:
Title: McNeil Generating Station Site

Project #: 57981.00
Sheet: 1 of 1
Date: 11/25/2019
Date:

		Unit	Qty	Unit Cost	Cost
Roadway	New Road Segment	LF	1300	$ 568	$738,636
Utilities	Electrical Connection	EA	1	$ 300,000	$300,000
Railroad	Railroad Siding	LF	1200	$ 250	$300,000
	Railroad turn out	EA	2	$ 75,000	$150,000
				Subtotal	$1,488,636
				Rounded total:	$1,500,000